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Modeling and development of screen-printed impedance biosensor for cytotoxicity studies of lung carcinoma cells (Article)

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Abstract

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Electrical cell-substrate impedance sensing (ECIS) is a powerful technique to monitor real-time cell behavior. In this study, an ECIS biosensor formed using two interdigitated electrode structures (IDEs) was used to monitor cell behavior and its response to toxicants. Three different sensors with varied electrode spacing were first modeled using COMSOL Multiphysics and then fabricated and tested. The silver/silver chloride IDEs were fabricated using a screen-printing technique and incorporated with polydimethylsiloxane (PDMS) cell culture wells. To study the effectiveness of the biosensor, A549 lung carcinoma cells were seeded in the culture wells together with collagen as an extracellular matrix (ECM) to promote cell attachment on electrodes. A549 cells were cultured in the chambers and impedance measurements were taken at 12-h intervals for 120 h. Cell index (CI) for both designs were calculated from the impedance measurement and plotted in comparison with the growth profile of the cells in T-flasks. To verify that the ECIS biosensor can also be used to study cell response to toxicants, the A549 cells were also treated with anti-cancer drug, paclitaxel, and its responses were monitored over 5 days. Both simulation and experimental results show better sensitivity for smaller spacing between electrodes. [Figure not available: see fulltext.]. © 2017, International Federation for Medical and Biological Engineering.

Reaxys Database Information

View Compounds

Author keywords

A549 ECIS Paclitaxel Screen-printed biosensor Silver/silver chloride electrode

Indexed keywords

Engineering controlled terms: Biological organs Cell culture Chlorine compounds Electric impedance measurement Electrodes Polydimethylsiloxane Screen printing Silicones Silver

Compendex keywords A549 ECIS Paclitaxel Screen-printed biosensors Silver/silver chloride electrodes

Engineering main heading: Biosensors

EMTREE drug terms: dimeticone paclitaxel silver silver chloride

EMTREE medical terms: Article cancer cell culture cell adhesion cell division cell function conductance cytotoxicity cytotoxicity test electric field electrical cell substrate impedance sensing extracellular matrix human human cell immunofluorescence microscopy impedance in vitro study lung carcinoma mitosis spindle priority journal

Chemicals and CAS Registry Numbers:

dimeticone, 32028-95-8, 68248-27-1, 9004-73-3, 9006-65-9; paclitaxel, 33069-62-4; silver, 7440-22-4; silver chloride, 7783-90-6

Drug tradename:

taxol

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SF16-004-0073	Kementerian Sains, Teknologi dan Inovasi	MOSTI	See opportunities by MOSTI
	Ministry of Education, Science and Technology	MEST	See opportunities by MEST
FRGS14-111-0352	Ministry of Higher Education, Malaysia	MOHE	See opportunities by MOHE

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